

# TOWNS

## Technologies and Operational Innovations for Urban Watershed Networks



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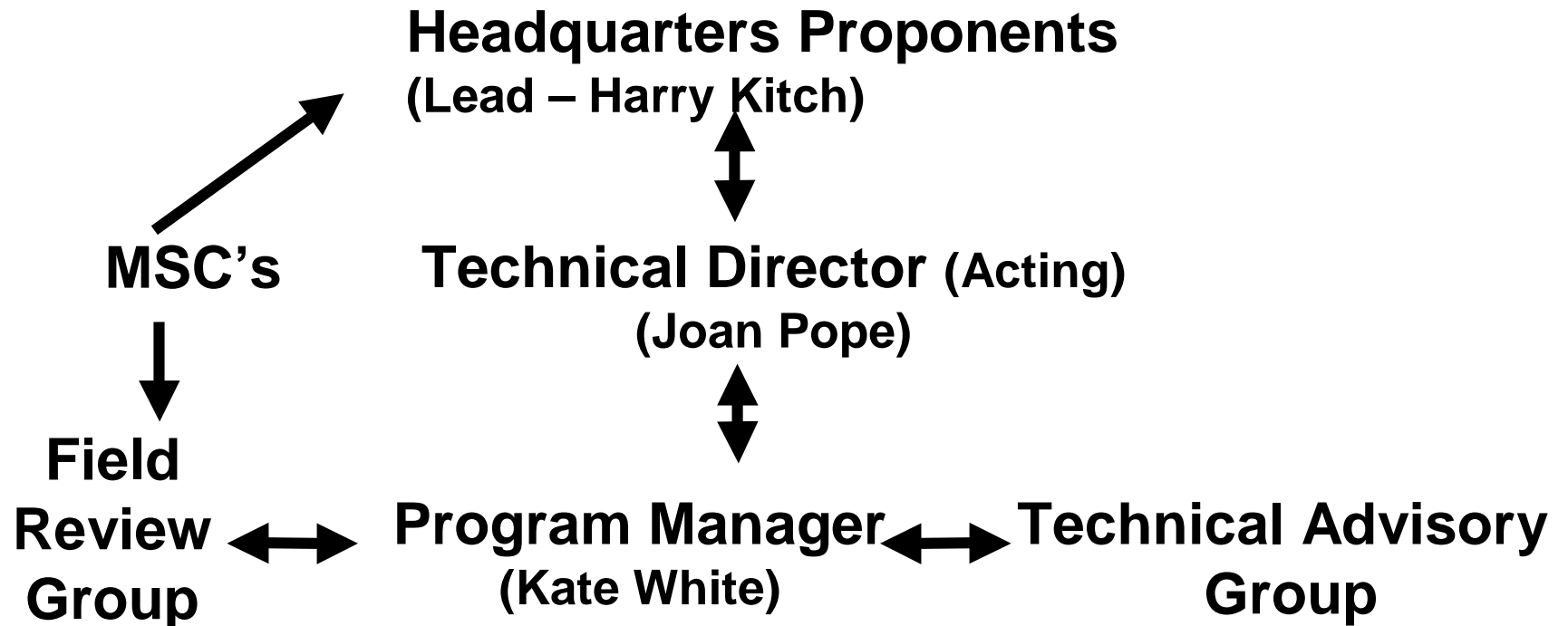
# Why TOWNS?

**Develop tools to effectively plan, design, construct, maintain, operate, and monitor urban channel systems to maximize and sustain flood damage reduction benefits (morphologically, environmentally, socially, and economically).**

- Unique treatments for Urban areas
- Need to think outside the box approaches
- Communication networks at risk
- Transportation corridors compromised
- Public facilities endangered
- Limitations on evaluation
- Dynamic and transitory situation
- Combination events (watershed, surge, and local percip)
- Flood routing controlled by engineering works
- Shore and flood proofing infrastructure



# TOWNS Program Structure



PI's



# TOWNS: 5 Focus Areas

1. Integrated Decision Methods
2. Sustainable Urban Flood Damage Reduction
3. System Monitoring
4. Expedient Emergency Operations
5. Technology Transfer



**Channels**

**Coastal**

**Urban**

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# **TOWNS Focus Area 1: Integrated Decision Methods**

**FOC: Integrated decision support tools and improved forecasting methodologies for use in flood damage reduction that incorporate changing urban settings, climate change, and extreme events**

- Improved real & near-real time modeling, simulation, and mapping, including hydrologic, geophysical, water quality, and structural failure

- Improved tools for evaluating sediment transport in urban channels
- Improved visualization, decision support, and data fusion tools
- Risk and uncertainty assessment methodologies (including those for coincident/combined events)



# **TOWNS Focus Area 2: Sustainable Urban Flood Damage Reduction**



**FOC: Methods and technologies for sustainable urban flood damage reduction (structural and nonstructural)**

- **Guidance for coastal/fluvial geomorphic assessments and stream corridor and shore restoration in urban watersheds**
- **Improved social-political, economic, and environmental assessment techniques**
- **Hazard mitigation planning activities**
- **Innovations in structural and nonstructural technologies**



# **TOWNS Focus Area 3: System Monitoring**

**FOC: Real-time surveys and system monitoring for improved condition assessment of flood damage reduction elements (i.e., levees, walls, dikes, channels, structures, etc.)**

- Remote and near-field sensing techniques
- Rapidly deployable and project-integrated monitoring systems
- Time-variable geospatial data management (GMS) system



# **TOWNS Focus Area 4: Expedient Emergency Operations**



**FOC: Expedient and cost-effective flood fighting and related emergency operations**

- **State of the art rapidly deployable technologies entering the marketplace or to be developed**
- **Post event forensics and lessons learned**
- **Technologies for post-storm rapid recovery**



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# TOWNS Focus Area 5: Technology Transfer



**FOC: Expedient and cost-effective flood fighting and related emergency operations**

- **State of the art rapidly deployable technologies entering the marketplace or to be developed**
- **Post event forensics and lessons learned**
- **Technologies for post-storm rapid recovery**



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# TOWNS

Proposal Title	Focus Areas	PIs	Organization
Integrated GIS and Modeling Methodologies for Inland Flood Protection Systems	<b>Integrated Decision Methods</b>	Birkenstock, Dunn, Heath, Carlock	CRREL, HEC, CHL, CEMVR
Real-time Modeling System for Coupled Coastal, Inland, and Urban Flood Prediction (modified to feed coastal and multiD in #13)		Richards, David and Mark, David	CHL, ITL, CRREL
Piping and Seepage (modified to fill geotech hole in #13 and #14)		Glynn	GSL, CEMVS, CEMVD
Rapid Assessment Sediment Transport Model Development for Urban Channels		Biedenharn, David and Brunner, Gary	CHL and HEC
Flood Frequency Analysis Methods for Changing (Non-Stationary) Urban Environments		Faber, Beth and Dunn, Chris	HEC
Coincident Frequency Analysis for Planning and Design in Urban Areas		Faber, Beth and Dunn, Chris	HEC



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# Work Unit: Nonstructural Analysis For Flood Damage Reduction

## Needs & Problems

### Addressed:

- nonstructural flood damage reduction analysis
- Provide integrated analysis tools to replace inefficient manual analysis

### Objectives:

- To develop and transfer new nonstructural analysis methods to enable the Corps to efficiently perform its flood damage reduction analysis responsibilities



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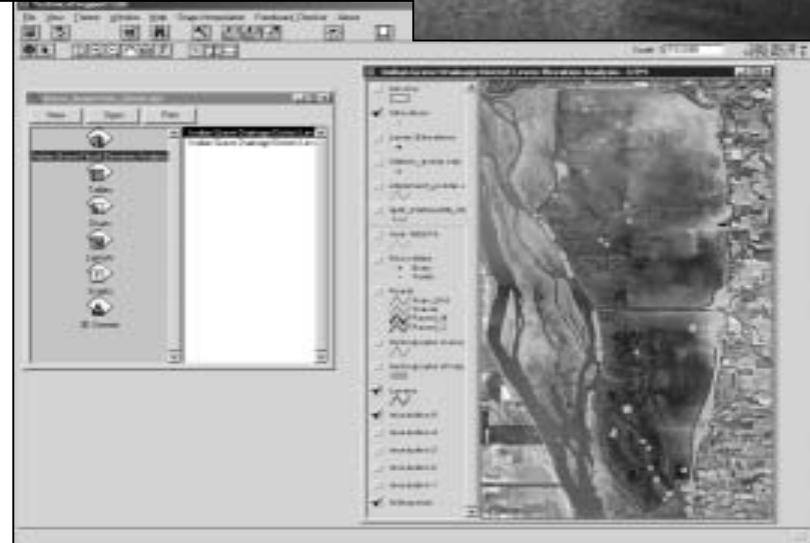
# Work Unit: Integrated GIS and Modeling Methodologies for Inland Flood Protection Systems

## Needs & Problems Addressed:

- EM & Post flood assessment require integrated GIS/H&H/inspection approach
- USACE's current modeling capabilities and tools are not typically built for integrated use across business practices

## Objectives:

- Integrate joint geospatial data access, modeling, and decision support aids throughout USACE
- Extend existing geospatial display and analysis tools to inland flood protection systems



# Work Unit: Flood Prediction System for Coastal Cities

## Needs & Problems Addressed:

- Prediction of combined coastal and riverine flooding in urban environment is difficult due to complex processes
- Currently there is no software application that adequately addresses multidimensional environmental, hydrologic/hydraulic, geotechnical, and logistical requirements in consolidated manner

## Objectives:

- Develop a hydroinformatic environment for urban settings based on multidimensional tools



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# Work Unit: Rapid Assessment Sediment Transport Model Development for Urban Channels

## Needs & Problems Addressed:

- SAM and HEC-6 are limited in their applications to complex urban systems
- Need a design methodology that integrates the channel morphology in the project reach with the watershed dynamics

## Objectives:

- Develop simple simulation procedure that balances water and sediment continuity along an urban stream network, with ability to assess impacts of channel and watershed alterations to channel morphology
- Adapt existing model to handle attributes common to urban channel systems, incorporate this model as a module within HEC-RAS



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Geomorphic Assessments for Urban Flood Damage Reduction	<b>Sustainable Urban Flood Damage Reduction</b>	Corcoran, Maureen, Biedenharn, David, and Stauble, Donald	GSL and CHL
Channel Restoration Design for Urban Flood Control Channels		Biedenharn, David and Fischenich, Craig	CHL and EL
Quantifying Vulnerabilities in Coastal Flood Damage Reduction Projects		Gravens, Mark and Stauble, Donald	CHL
Innovative Management of Stormwater for Flood Damage Reduction		Fischenich, Craig and Biedenharn, David	EL and CHL
Nonstructural Analysis for Flood Damage Reduction		Carl, Robert, Dunn, Chris, and CHL TBD	HEC, IWR, CHL
Recovering Flood Damaged Structures Using Electro-Osmotic Pulse (EOP) Technology		Hock, Vincent	CERL and GSL
Innovative, Rapidly Deployed/Removable/Reusable Flood-Protection System for Urban Environments		Ebeling, Robert & Merrill, Chris	ITL
Valuation for Alternative Uses of Evacuated Floodplains (combined 30 and 43)		Davis, Stuart, Pitts, Don, and Caldwell, Hal	IWR and CERL

# Work Unit: Geomorphic Assessments for Urban Flood Damage Reduction

## Needs & Problems Addressed:

- Lack of complete information in geomorphic assessments does not allow USACE decision-makers to optimally design, construct, and maintain projects to meet the stated flood control and environmental goals

## Objectives:

- Develop guidance, procedures, and methods to conduct systematic and appropriately scoped geomorphic assessments
  - Determine characteristics of geomorphic assessments
  - Develop a conceptual geomorphic assessment procedure
  - Apply procedure to several projects at different scopes
  - Revise assessment procedure and make it applicable to USACE projects





# Work Unit: Quantifying Vulnerabilities in Coastal Flood Damage Reduction Projects

## Needs & Problems Addressed:

- Impact of coastal storms and the non-uniform performance of beach nourishment projects for coastal storm and flood damage reduction can result in the expenditure of considerable operation and maintenance and emergency operations resources
- Corps requires a standard method to quantify vulnerability, identify renourishment needs and assess risks in not renourishing

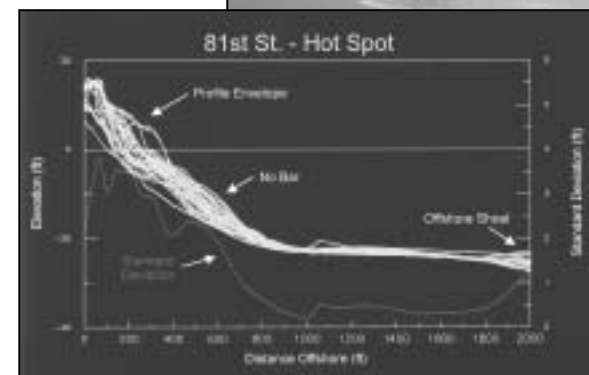
## Objectives: To improve -

- Justification for renourishment
- Hot spot identification
- Risk assessment and remediation
- Guidance on storm damage mitigation



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# Work Unit: Innovative Management of Stormwater for Flood Damage Reduction and Ecosystem Restoration

## Needs & Problems Addressed:

- Stormwater management practices are underutilized in conventional flood damage reduction efforts
- Current practices result in system degradation due to extended duration
- Significant ecological and economic impacts

## Objectives:

- Guidelines and tools for planning, assessment and design
- New designs to better simulate natural hydrograph and prevent system degradation



# Work Unit: Valuation for Alternative Uses of Evacuated Floodplains

## Needs & Problems Addressed:

- Difficult for USACE districts to formulate and conduct economic evaluation of projects without ability to assess suitable uses for evacuated land
- Few tools allow valuation of environmental benefits

## Objectives:

- Provide USACE districts with methodologies to evaluate environmental benefits of alternative uses of an evacuated floodplain



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Above: Wisconsin floodplain; Left: ground view of the floodplain.

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Flood Monitoring for Urban Watershed Networks (combined 46, 53, and 54)	<b>System Monitoring</b>	Birkenstock, Terry, Williams, Christopher, McCleave, Barry, and Hunter, John	CRREL, ITL, and CELRN
Geophysical Modeling for Anomalous Seepage Assessment and Long-Term Monitoring		Butler, Dwain	GSL, CHL, and ITL
Geophysical Techniques for Rapid Ground Assessment of Levees		Llopis, Jose	GSL and CRREL
High Resolution Nowcasting and Forecasting of Precipitation During Landfalling Tropical Cyclones		Garcia, Andrew	CHL



# Work Unit: Geophysical Techniques for Rapid Ground Assessment of Levees

## Needs & Problems Addressed:

- Corps needs smarter, more rapid, user-friendly inspection tools that will probe the subsurface of flood-protection infrastructure to help avoid failures and target use of limited resources for repair and maintenance

## Objectives:

- Develop towed survey tool with a combination of geophysical methods suited to operating without mutual interference and capable of rapid data analysis and visualization



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Hydrodynamic Evaluation of Innovative Flood Fighting Structures (combined with #60 and #45)	<b>Expedient Emergency Measures</b>	Carver, Robert, Wibowo, Johannes, Taylor, Perry, Olsen, Richard, and Malone, Philip	CHL, GSL, EL
Helicopter-based Emergency Computer Systems for Reconnaissance Efforts During Flood Fighting		Olsen, Richard, Matheu, Enrique, Blake, Henry, and Taylor, Perry	GSL and ITL
Tools for Rapid Field Assessment During Floods		Olsen, Richard, Matheu, Enrique, and Blake, Henry	GSL and ITL
Low-cost Deployable Piezometric Measuring Columns		Olsen, Richard, Blake, Henry, and Taylor, Perry	GSL and ITL
Urban Watershed Technology Resource Network	<b>Technology Insertion</b>	Schroeder, Charles	CERL, CRREL, CHL, ITL, and ERDC



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# Work Unit: Data Acquisition and Delivery Tools for Monitoring Watershed Networks

## Needs & Problems Addressed:

- Near real-time data is often too widely space and slow to provide critical information in urban settings
- Need a versatile, low-cost, fixed site, and rapidly deployable sensor system capable of providing real-time data to forecast modelers, USACE, and local emergency operations personnel

## Objectives:

- Identify processes and physical variables that need monitoring, identify new sensor needs, survey and evaluate appropriate existing and emerging sensor technology
- Develop a rapidly deployable, stand alone acquisition package to visually monitor and report the conditions of a river system and serve as a flashflood warning activation tool
- Evaluate the use of web-based tools for simplified integration of real-time sensor data feeds



# TOWNS Status & Budget

FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10
2M	3M	4M	4.5M	4M	3.5	3M	2M

**23 May 2002** PDG meets, identifies 150% program ✓  
**7 June 2002** Technical Advisory Group completes proposal  
 review and advises PM ✓  
**14 June 2002** Modified proposals submitted by PI's ✓  
**18 June 2002** General overview briefing to PI's ✓  
**11 July 2002** Progress briefing to PI's ✓  
**19 July 2002** TOWNS input to CW R&D website  
**19 July 2002** Select and notify FRG  
**20 Aug 2002** Brief TOWNS to PMB and HQUSACE  
**21-22 Aug 2002** FRG meeting (Atlanta –Tentative)  
**30 Aug 2002** Final program selection to HQ  
**1 Sept 2002** TOWNS briefed to HQUSACE  
**1 Oct 2002** FY03 Appropriation





# TOWNS Proposals

FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10
2M	3M	4M	4.5M	4M	3.5	3M	2M

**General Statistics: 64 proposals totaling \$10.98M in FY03**

- **Integrated Decision Methods 29 proposals totaling \$5.19M in FY03**
- **Sustainable Urban Flood Damage Reduction 25 proposals totaling \$5M in FY03**
- **System Monitoring 18 proposals totaling \$3.22M in FY03**
- **Expedient Emergency Measures 15 proposals totaling \$1.92M in FY03**
- **Technology Transfer 5 proposals totaling \$640K in FY03**

